

1 **What is claimed is:**

2 1. A fitness function circuit for determining the fitness of a potential solution for a
3 genetic algorithm problem, said fitness circuit comprising:

4 a solution register containing said potential solution for said genetic algorithm
5 problem therein, said solution register comprising a plurality of component parts thereof;

6 a plurality of data tables, the number of data tables corresponding to the number
7 of said component parts of said solution register, respective data tables having inputs
8 from two respective ones of said component parts of said solution register, each of said
9 data tables comprising a matrix of partial solutions to said genetic algorithm problem, the
10 two respective ones of said component parts determining a particular respective partial
11 solution, each of said matrices having identical entries therein; and

12 an adder connected to each of said plurality of data tables, said adder adding
13 respective partial solutions from each of said plurality of data tables, thereby determining
14 the fitness of said potential solution for said genetic algorithm problem.

15 2. The fitness function circuit according to claim 1, wherein said data tables include
16 partial solutions specific to the sequential order of the potential solution.

17 3. The fitness function circuit according to claim 1, wherein said adder adds said
18 partial solutions from the respective data tables in parallel.

19 4. The fitness function circuit according to claim 3, wherein said partial solutions
20 from the respective data tables are added substantially simultaneously.

21 5. The fitness function circuit according to claim 1, wherein each of said matrices
22 within said data tables comprises an abbreviated matrix of partial solutions to said genetic
23 algorithm problem.

24 6. The fitness function circuit according to claim 5, wherein said abbreviated matrix
25 contains at least $(n)(n-1)/2$ entries.

26 7. The fitness function circuit according to claim 1, wherein at least two of the two
27 respective ones of said component parts correspond to different entries within said
28 matrices.

29 8. The fitness function circuit according to claim 7, wherein all of the two respective
30 ones of said component parts correspond to different entries within said matrices.

31 9. The fitness function circuit according to claim 8, wherein said genetic algorithm
32 problem is the Traveling Salesman Problem.

33 10. A method for determining the fitness of a potential solution for a genetic
34 algorithm problem, said method comprising the steps of:

- 1 inputting a plurality of potential solution values into a solution register, said
- 2 solution register comprising a plurality of component parts thereof;
- 3 receiving, after said step of inputting, at each of a plurality of data tables two
- 4 respective ones of said component parts of said solution register, the number of data
- 5 tables corresponding to the number of said component parts of said solution register, each
- 6 of said data tables comprising a matrix of partial solutions to said genetic algorithm
- 7 problem, each of the matrices having identical entries therein;
- 8 indexing said matrices of partial solutions to said genetic algorithm within said
- 9 plurality of data tables, the two respective ones of said component parts determining
- 10 respective particular partial solutions within the respective matrices; and
- 11 adding, by an adder connected to each of the respective data tables, respective
- 12 outputs from each of said data tables, whereby the sum of said adder determines the
- 13 fitness of said potential solution for said genetic algorithm problem.
- 14 11. The method according to claim 10, wherein in said step of receiving, at each of
- 15 said plurality of data tables, two respective ones of said component parts of said solution
- 16 register are received substantially simultaneously.
- 17 12. The method according to claim 10, wherein in said step of receiving, wherein at
- 18 least two of the two respective ones of said component parts correspond to different
- 19 entries within said matrices.
- 20 13. The method according to claim 12, wherein all of the two respective ones of said
- 21 component parts correspond to different entries within said matrices.
- 22 14. The method according to claim 13, wherein said genetic algorithm problem is the
- 23 Traveling Salesman Problem.
- 24 15. The method according to claim 10, wherein in said step of receiving, at each of
- 25 said plurality of data tables, two respective ones of said component parts of said solution
- 26 register correspond to the sequential order of the potential solution values in said solution
- 27 register.
- 28 16. A methodology for determining the fitness of a particular potential solution for a
- 29 genetic algorithm problem from a pool of potential solutions, said methodology
- 30 comprising steps of:
- 31 (a) inputting a plurality of potential solution values into a solution register, said
- 32 solution register comprising a plurality of component parts thereof;
- 33 (b) receiving, substantially simultaneously, at each of a plurality of data tables two
- 34 respective ones of said component parts of said solution register, the number of data

1 tables corresponding to the number of said component parts of said solution register, each
2 of said data tables comprising a matrix of partial solutions specific to said genetic
3 algorithm problem, each of the matrices having identical entries therein;

4 (c) indexing said matrices of partial solutions to said genetic algorithm within said
5 plurality of data tables, the two respective ones of said component parts determining
6 respective particular partial solutions within the respective matrices;

7 (d) adding, by an adder connected to each of the respective data tables, respective
8 outputs from each of said data tables in parallel, whereby the sum of said adder
9 determines the fitness of said particular potential solution for said genetic algorithm
10 problem;

11 (e) comparing the fitness of said particular potential solution to a fitness threshold;
12 and

13 (f) replacing a prior potential solution from said pool of potential solutions with
14 said particular potential solution if said fitness of said particular potential solution
15 exceeds said fitness threshold, and otherwise deleting said particular potential solution.

16 17. The methodology according to claim 16, said methodology repeating said steps (a)
17 – (f) with another particular potential solution with the same matrix of partial solutions.

18 18. The methodology according to claim 16, said methodology repeating said steps (a)
19 – (f) with another particular potential solution with another matrix of partial solutions,
20 said another matrix corresponding to partial solutions for another genetic algorithm
21 problem.